Technoleg Iechyd Cymru
Health Technology Wales

Health Technology Wales (HTW) Guidance 067
May 2025

Smartphone based photoplethysmography for the detection and monitoring of atrial fibrillation

HTW Guidance:

Smartphone photoplethysmography (PPG) shows promise for the detection and monitoring of atrial fibrillation in adults with known or suspected atrial fibrillation, but the evidence is insufficient to support routine adoption.

The available evidence indicates that PPG applications have good diagnostic accuracy, and their use could potentially lead to a reduction in resource use and a faster diagnosis for some patients.

The evidence to support longer-term effectiveness and long-term resource use savings is limited and there is not enough evidence to support the cost effectiveness of smartphone PPG.

The Appraisal Panel strongly encourages further research generation in this area.

Why did Health Technology Wales (HTW) appraise this topic?

More than 1.6 million people have been diagnosed with atrial fibrillation (AF) in the UK and more than 80,000 people have been diagnosed in Wales. In Wales, atrial fibrillation is a contributing factor to one in five strokes and there are approximately 15,000 people aged 65 years or older with undiagnosed AF. Atrial fibrillation has a broad impact on health services across both primary and secondary care.

The development of smartphone-based screening and monitoring devices has the potential to increase screening coverage, improve clinical detection, and facilitate the monitoring of AF without the need for external and additional hardware.

This topic was proposed by a device manufacturer (FibriCheck).

The status of HTW guidance is that NHS Wales should adopt this guidance or justify why it has not been followed. HTW will evaluate the impact of its guidance.

Evidence summary

Refer to Evidence Appraisal Report 067 (EAR067) for a full report of the evidence supporting this Guidance.

The EAR aimed to identify and summarise evidence that addresses the following question: What is the clinical and cost effectiveness of smartphone based photoplethysmography (PPG) for the detection and monitoring of AF among people with suspected or confirmed AF?

HTW researchers identified 11 observational studies. The evidence included in this review suggests there are outcomes to support the effectiveness of PPG applications to detect AF in those with known AF or in those being monitored for AF. However, the statistical significance of some outcomes was not reported and there are several limitations of the studies that are noted in this review. Outcomes reported in the evidence base included diagnostic accuracy which were reported across nine studies: sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), correctly classified rate, rate of no diagnosis, overall accuracy and atrial arrhythmia recurrence rate. Other outcomes included resource use (reported in two studies), environmental outcomes (reported in one study), patient compliance (reported in three studies), signal quality and technical failure (reported in five studies) changes to patient management (reported in one study), and adverse events (reported in one study). HTW researchers did not identify any quality-of-life outcomes. Evidence to support longer-term effectiveness and long-term resource use savings is limited.

One directly applicable economic analysis was identified which considered a retrospective analysis of UK patients using the FibriCheck smartphone app in comparison to 12-lead ECG monitoring. The study showed that healthcare costs were significantly lower in patients managed with PPG. However, this estimation was based only on the FibriCheck activation charge and the cost of ECG appointments. In addition, the retrospective design of the analysis could introduce some bias due to differences in the characteristics of the intervention and comparator cohorts. We did not develop an economic model to estimate the cost effectiveness of PPG as, after consultation with experts, it was determined that the evidence base was insufficient to be used as the basis for an economic evaluation.

The appropriate mechanism for patient engagement was determined and the patient perspective was considered where possible.

Appraisal Panel considerations

- The Appraisal Panel heard from experts that the number of people living with or at risk of heart disease has increased over the last decade, which has led to an increased demand for services. Inequalities within care pathways have also been magnified since the COVID-19 pandemic.

- The Appraisal Panel heard from clinical experts that the evidence base was reflective of their current practice. PPG applications can be used for the monitoring of atrial fibrillation with the help of clinicians, as a screening system alongside clinicians (on a timed basis), and in acute care whereby the PPG applications can be used for 12 hours per day with close supervision.

- The experts shared their experience with the device and noted that it is generally well liked, and patients find it easy to use. However, it was noted that using the technology in isolation is not enough to generate the care needed to improve the care pathway. Consideration would need to be given to the infrastructure required to properly implement the technology. Experts noted that there are secondary care diagnostic units in Wales, but this would be an additional

workload for them, and options should be discussed with the patient to see what would suit them best.

- The Appraisal Panel acknowledged that the clinical effectiveness evidence is based on observational studies only and they include a mixture of populations and comparators. HTW did not identify any randomised controlled trials (RCTs) that aligned with the research question being addressed in the appraisal.

- The Appraisal Panel considered the evidence on diagnostic accuracy and noted that the values with PPG were lower than gold standard measurement using 12-lead ECG. The panel heard from experts that, while the accuracy of PPG is likely to always be lower than 12-lead ECG, PPG when used alongside clinical judgement could enable quicker access to 12-lead ECG in those that require it and faster diagnosis overall.

- The Appraisal Panel discussed the risk of digital exclusion among older patients and heard from an expert that had experienced this issue in their practice. In this instance, the expert reassured the panel that whilst this technology was offered, other alternative services were made available for patients to access. One appraisal panel member agreed that underserved populations are less likely to have such digital devices, so loaning devices for the duration of screening could help.

- The Appraisal Panel discussed how the technology could be useful in underserved populations in primary care. The technology could save travel time and money for patients who live in remote areas. Evidence from the economic analysis estimated the potential cost savings that patients may accrue but not travelling to hospital and paying parking charges. The evidence also showed a potential reduction in carbon emissions by reducing travel time.

- The Appraisal Panel heard from experts that information governance could be an issue when implementing the technology in Wales. Experts highlighted that this had been a barrier to overcome when implementing single lead ECG devices, such as KardiaMobile, in Wales.

- The Appraisal Panel heard from clinical experts that they are increasingly asked by patients whether they should purchase monitoring devices including PPG applications. This puts clinicians in an uncomfortable situation as such devices are then purchased at the patient's expense. One expert noted that they would not tell patients to buy PPG applications but if asked directly, then they would give information about the technology to help the patient make an informed decision about whether to purchase the device or application.

- The Appraisal Panel considered the evidence on the cost effectiveness of smartphone-based PPG devices. The panel agreed that it is likely that using PPG would be cost saving compared to 12-lead ECG and indeed there is evidence estimating potential cost savings. However, there is a lack of evidence demonstrating the impact on patient outcomes and there is a need for reassurance on this aspect given the poorer accuracy of PPG compared to 12-lead ECG. Therefore, the cost effectiveness of PPG devices in comparison to 12-lead ECG remains uncertain.

- The Appraisal Panel heard from experts that single-lead or six-lead ECG devices such as KardiaMobile would be a more appropriate comparator to consider in future research. Experts noted that such devices are currently easier to access than PPG devices but there have been reports of patients losing the devices or not returning them. Using smartphone-based PPG could therefore confer some advantages as additional hardware is not required.

- The Appraisal Panel agreed that further research should be strongly encouraged in this area. Technologies of this nature are already being used in practice, and it is seen as valuable to clinicians, but the care pathway needs to be developed to ensure that appropriate evidence can be generated. The panel encourages the collection of real-world evidence with a focus on populations where it would be of most benefit.

Appraisal Panel considerations: May 2025

Publication of guidance: August 2025

Responsibilities for consideration of this Guidance

Health Technology Wales (HTW) was established by Ministerial recommendation[1,2] to support a strategic, national approach to the identification, appraisal and adoption of non-medicine health technologies into health and care settings. The HTW Appraisal Panel comprises senior representation from all Welsh boards with delegated authority to produce guidance 'from NHS Wales, for NHS Wales'. The status of HTW guidance is 'adopt or justify'. There is an expectation from Welsh Government that HTW guidance is implemented with adoption regularly audited by HTW.[3]

The guidance in this document is intended to assist Welsh care system decision makers to make evidence-informed decisions when determining the place of health technologies and thereby improve the quality-of-care services.

The content of this HTW guidance was based upon the evidence and factors available at the time of publication. An international evidence base was reviewed and external topic experts and HTW committee members consulted to contextualise available evidence to Wales. Readers are asked to consider the generalisability of the evidence reviewed to NHS Wales and that new trials and technologies may have emerged since first publication and the evidence presented may no longer be current. It is acknowledged that evidence constitutes only one of the sources needed for decision making and planning.

This guidance does not override the individual responsibility of health professionals to make decisions in the exercise of their clinical judgment in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

No part of this guidance may be used without the whole of the guidance being quoted in full. This guidance represents the view of HTW at the date noted. HTW guidance is not routinely updated. It may, however, be considered for review if requested by stakeholders, based upon the availability of new published evidence which is likely to materially change the guidance given.

Standard operating procedures outlining HTW's evidence review methods and framework for producing its guidance are available from the HTW website.

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Declarations of interest were sought from all reviewers. All contributions from reviewers were considered by HTW's Assessment Group. However, reviewers had no role in authorship or editorial control and the views expressed are those of Health Technology Wales.

Chair, Health Technology Wales Appraisal Panel

1. National Assembly for Wales, Health and Social Care Committee. Access to medical technologies in Wales. December 2014.
2. Response to Recommendations from the Health & Social Care Committee: Inquiry into Access to Medical Technologies in Wales. February 2015.
3. Gething, V. Letter to all Health Board Chairs re Funding for Sacral Nerve Stimulation in Wales. VG_01655_17. September 2017.